

THIRD SEMESTER B.Sc. DEGREE (SUPPLEMENTARY/IMPROVEMENT)
EXAMINATION, NOVEMBER 2015

(UG—CCSS)

Complementary Course

PH 3C 05—OPTICS, LASER, ELECTRONICS AND COMMUNICATION

(2013 Admissions)

Time : Three Hours

Maximum : 30 Weightage

I. Answer *all* questions :

Choose the correct alternative.

- 1 For destructive interference the path difference between the two rays is :
(a) Even multiple of $\lambda/2$. (b) Odd multiple of $\lambda/2$.
(c) Integral multiple of $\lambda/2$. (d) None of these.
- 2 The basic principle of propagation of modulated signals through optical fiber is :
(a) Total internal reflection. (b) Scattering of light.
(c) Refraction. (d) Diffraction.
- 3 The Universal logic gates are :
(a) OR and NOT. (b) OR and NOR.
(c) AND and NOR. (d) AND and NOT.
- 4 Nicol prism can be used as :
(a) Analyzer.
(b) Polarizer.
(c) Both analyzer and polarizer.
(d) None of these.

Fill in the blanks :

- 5 For interference, the sources must be _____.
- 6 The basic principle of laser is _____.
- 7 Extracting information from a modulated signal is known as _____.
- 8 Gallium Arsenide laser is an example of a _____ laser.

Give one word answers :

- 9 What is the formula for fringe width ?
- 10 Which logic gate has an output 1 when all inputs are 1 ?
- 11 What is the name of substances which rotate the plane of polarization (or plane of vibration) in the clockwise direction with respect to the observer looking towards the light ?
- 12 What is the frequency of oscillations produced in an LC circuit with $L = 1 \text{ mH}$ and $C = 0.1 \mu\text{F}$?

($12 \times \frac{1}{4} = 3$ weightage)

Answer all *nine* questions :

- 13 State Fermat's principle.
- 14 What are the differences between Fresnel diffraction and Fraunhofer diffraction ?
- 15 Distinguish between modulation and demodulation.
- 16 What is a step index fiber ?
- 17 Explain how optical fibers can be used for communication.
- 18 Define Numerical Aperture.
- 19 Distinguish between amplitude modulation and frequency modulation.
- 20 What are the advantages and disadvantages of semiconductor lasers ?
- 21 Explain the term 'population inversion'.

($9 \times 1 = 9$ weightage)

Answer any *five* questions :

- 22 Describe the construction and working of a Ruby Laser.
- 23 Explain the terms double refraction, optic axis, principal plane and principal section.
- 24 What are half wave and quarter wave plates ? Calculate the thickness of (i) a quarter wave plate ; and (ii) a half wave plate. Given $\mu_g = 1.553$, $\mu_o = 1.544$ and $\lambda = 500 \text{ nm}$.
- 25 Explain negative feedback. An amplifier has a voltage gain of 1000. With negative feedback, the voltage gain reduces to 10. Calculate the fraction of the output voltage that is given as negative feedback.
- 26 In a biprism experiment the separation of coherent sources is 1 mm. The fringe width is measured to be 0.35 mm at a certain distance and 0.05 mm when the distance is decreased by 50 cm. Calculate the wavelength of light used.
- 27 Calculate the number of half period zones in a hole of radius 1 mm with respect to a point 40 cm away from it for a plane wave of wavelength 589 nm.
- 28 What is modulation and demodulation ? Explain frequency and pulse modulations.

($5 \times 2 = 10$ weightage)

7. Answer any two questions :

- 29 Draw the CB, CE and CC configurations and draw their output characteristics. Define α and β and obtain the relationship between them.
- 30 Describe with necessary theory the determination of wavelength of sodium light using Newton's rings arrangement.
- 31 Describe the construction and theory of a plane transmission grating.

(2 × 4 = 8 weightage)